

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-013039

(43)Date of publication of application : 17.01.1995

(51)Int.Cl.

G02B 6/30

G02B 6/26

(21)Application number : 05-150739

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(22)Date of filing : 22.06.1993

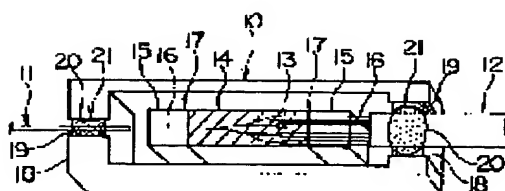
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(54) OPTICAL WAVEGUIDE MODULE

(57)Abstract:

PURPOSE: To provide the optical waveguide module which obviates the breakdown of a coupling part of an optical waveguide and optical fiber housed in a casing and the generation of optical axis misalignment in this part even if tensile force acts on the optical fiber.

CONSTITUTION: A waveguide substrate 14 having the optical waveguide 13 is housed in the casing 10 and an optical connector 15 connected with the bare optical fiber 16 is adhered to the end face of the optical waveguide substrate 14, by which a first 17 is formed. The coated optical fiber 11 and an



optical fiber ribbon 12 are inserted through the side wall 18 of the casing 10 and

introduced to the inside thereof and the coating part of the coated optical fiber 11 and the optical fiber ribbon 12 is connected to the side wall 18 of the casing 10 by an adhesive 20, by which a second holding part 21 is formed. The second holding part 21 is provided with the strength of adhesion higher than the strength of adhesion of the first holding part 17.

LEGAL STATUS

[Date of request for examination] 19.07.1999

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3259742

[Date of registration] 14.12.2001

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The optical-waveguide module characterized by for the bond strength of the 2nd attaching part which is jointing of the aforementioned optical fiber and the aforementioned housing to be larger than the bond strength of the 1st attaching part which is jointing of the aforementioned optical-waveguide end face and the aforementioned optical fiber end face in the optical-waveguide module which pasted up the end face of an optical fiber on the end face of the optical waveguide formed in the waveguide substrate, constituted the main part of a module, contained this main part of a module in the housing, and drew the aforementioned optical fiber out of the aforementioned housing.

[Claim 2] The 2nd attaching part of the above is an optical-waveguide module according to claim 1 constituted by fixing the covering section of the aforementioned optical fiber to the aforementioned case with adhesives.

[Claim 3] The 2nd attaching part of the above is an optical-waveguide module according to claim 1 constituted by fixing to a case the covering section located in the nakedness fiber section from which a part of covering section at the nose of cam of the aforementioned optical fiber was removed, and the edge of this nakedness fiber section with adhesives.

[Claim 4] The 2nd attaching part of the above is an optical-waveguide module according to claim 1 which consists of noses of cam of the aforementioned optical fiber by fixing to a case the covering section located in the nakedness fiber section from which a part of front covering section was removed, and the both ends of this nakedness fiber section with adhesives.

[Claim 5] In the optical-waveguide module which pastes up the end face of an optical fiber on the end face of the optical waveguide formed in the waveguide substrate, constitutes the main part of a module, contains this main part of a module in a case, and comes to draw the aforementioned optical fiber out of the aforementioned case While supporting the aforementioned main part of a module to the susceptor contained in the aforementioned case The optical-waveguide module which pastes up the optical fiber drawn out of the aforementioned case by the aforementioned susceptor, constitutes the 2nd attaching part, and is characterized by the bond strength of this 2nd attaching part being larger than the bond strength of the 1st attaching part which is jointing of the aforementioned optical-waveguide end face and the aforementioned optical fiber end face.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the optical-waveguide module used for an optical fiber communications network etc.

[0002]

[Description of the Prior Art] Generally the end face of an optical waveguide and the end face of an optical fiber are pasted up, and the main part of a module is constituted, and this main part of a module is contained in the case which enclosed nitrogen gas etc., and it consists of optical-waveguide modules. In this optical-waveguide module, in order to stabilize the main part of a module so that it may shift and may not move within a case, adhesion fixation of the covering section of an optical fiber is carried out at a part of case.

[0003] By the way, even if the main part of a module shifts, and it makes it not move within a case and the force acts on an optical fiber from the exterior, in order to make it the bond part of an optical waveguide and an optical fiber not fracture, it is required to fix the part and optical fiber of a case and to improve the intensity of the bond part of an optical waveguide and an optical fiber as mentioned above.

[0004] About how to raise the intensity of the bond part of each end face of an optical waveguide and an optical fiber, many things are examined conventionally. However, the bond part of this optical waveguide and optical fiber was difficult for aligning an optical axis, and moreover, giving high intensity to the bond part, since there are many restrictions of having to use the resin which was able to take the index matching of an optical waveguide and an optical fiber.

[0005] Moreover, since the degree of adhesion of an optical waveguide and an optical fiber is increased, it may consider as structure as shown in drawing 6 . That is, block 3 is carried in the upper surface of the waveguide substrate 2 in which the optical waveguide 1 was formed, the connector 5 of reliance linked to the edge of an optical fiber 4 is in the end face of the waveguide substrate 2, and the end face of block 3, and it fixes with adhesives.

[0006] With the structure of drawing 6 , block 3 is carried on the waveguide substrate 2, and improvement in on the strength of the bond part of the waveguide substrate 2 and an optical fiber 4 is aimed at by increasing adhesion area with a connector 5 as much as possible. However, according to this method, the alignment of block 3 etc. must do the required work of attentiveness.

[0007] On the other hand, although examination is performed about the enclosure nature (sealing performance) of nitrogen gas or other gas enclosed with a case for contact section protection with an optical waveguide and an optical fiber, ***** examination is not carried out about the intensity of the portion which fixes a case and an optical fiber. Therefore, in an optical-waveguide module, although the bond part of a case and an optical fiber could be equal to thermal expansion or contraction, there was a problem of being weak in the mechanical flare intensity concerning an optical fiber.

[0008]

[Problem(s) to be Solved by the Invention] As mentioned above, by the conventional optical-waveguide module, the intensity of the fixed part of a case and an optical fiber and the intensity of the bond part of an optical waveguide and an optical fiber were weak, when pull strength acted on an optical fiber, this force got across to the bond part of an optical waveguide and an optical fiber, and there was a problem of an optical-axis gap having arisen or fracturing by this bond part.

[0009] this invention aims at offering the optical-waveguide module which solved the above-mentioned trouble.

[0010]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention pastes up the end face of an optical fiber on the end face of the optical waveguide formed in the waveguide substrate, the main part of a module is constituted, and this main part of a module is contained in a housing, and in the optical-waveguide module which drew the optical fiber out of the housing, it is characterized by the bond strength of the 2nd attaching part which is jointing of an optical fiber and a housing being larger than the bond strength of the 1st attaching part which is jointing of an optical-waveguide end face and an optical fiber end face

[0011] As for the 2nd attaching part of the above, it is good to fix to a case with adhesives and to constitute the covering section of an optical fiber.

[0012] As for the 2nd attaching part of the above, it is good to fix to a case with adhesives and to constitute the covering section located in the nakedness fiber section from which a part of covering section at the nose of cam of an optical fiber

was removed, and the edge of this nakedness fiber section.

[0013] Furthermore, as for the 2nd attaching part of the above, it is good to fix to a case with adhesives and to constitute the nakedness fiber section from which a part of front covering section was removed, and the covering section located in the ends of this nakedness fiber from a nose of cam of an optical fiber.

[0014] Moreover, this invention pastes up an optical fiber end face on the end face of the optical waveguide formed in the waveguide substrate, constitutes the main part of a module, contain this main part of a module in a case, and an optical fiber is set to the optical-waveguide module which it comes to draw out of a case. While supporting the main part of a module to the susceptor contained in the case, paste up the above-mentioned optical fiber drawn out of a case on the above-mentioned susceptor, and the 2nd attaching part is constituted. It is characterized by making the bond strength of this 2nd attaching part larger than the bond strength of the 1st attaching part which is jointing of an optical-waveguide end face and an optical fiber end face.

[0015]

[Function] According to the above-mentioned composition, since the bond strength of the 2nd attaching part is made larger than the bond strength of the 1st attaching part, even if external force acts on an optical fiber, this external force can be received by the 2nd attaching part, and does not require the superfluous hauling force for the bond part of an optical waveguide and an optical fiber, but becomes strong in the hauling force with the 1st mechanical attaching part.

[0016] Moreover, in the 2nd attaching part, intensity increases further by applying adhesives to both the nakedness fiber section at the nose of cam of an optical fiber, and the covering section. This reason is because a nakedness fiber and the covering section of the circumference may exfoliate inside the optical fiber covering section and this fear has the hauling force in the bond part of the nakedness fiber section and an optical waveguide directly according to the hauling force.

[0017]

[Example] The example of this invention is explained with reference to drawing below.

[0018] Drawing 1 is the perspective diagram of the optical-waveguide module concerning the 1st example, and the interior of a case 10 is shown. It is combined with the optical waveguide 13 from which the optical fiber core wire 11 of the 1 heart and the optical fiber tape 12 of the 8 hearts constitute the turnout of 1x8 in a case 10 through the connector 15, and the main part of a module is constituted from this 1st example by these each part material.

[0019] That is, the optical waveguide 13 is formed as 1x8 fork roads by the flame

depositing method on the waveguide substrate 14 which consists of Si material. In the ends of the waveguide substrate 14, the connector 15 has fixed with adhesives, respectively, and it considers as the 1st attaching part 17 to which the fixing section of this waveguide substrate 14 and connector 15 carries out optical coupling of the optical fiber open wire 16 to an optical waveguide 13.

[0020] It aligns and the incidence side of an optical waveguide 14 is combined so that each optical axis may suit the optical fiber core wire 11 of the 1 heart through the connector 15 on the left-hand side of drawing 1 . Moreover, it aligns and the outgoing radiation side of an optical waveguide 14 is combined so that each optical axis may suit the optical fiber tape 12 through the connector 15 on the right-hand side of drawing 1 . ** and a connector 15 have the V groove formed in Si chip by each, insert the optical fiber open wire 16 in this V groove, and are constituted, a connector end face uses adhesives for the end face of the waveguide substrate 14, and adhesion fixation of them is carried out.

[0021] Moreover, to signal light, the above-mentioned adhesives which fix the waveguide substrate 14 and a connector 15 are transparent, and are restricted to the thing of the kind by which the refractive index of an optical waveguide 13 and the optical fiber open wire 16 was adjusted.

[0022] Some end faces of the both-sides side attachment wall 18 of a case 10 can be dented, and the optical fiber core wire 11 of the 1 heart and the multi-core optical fiber tape 12 are inserted in each crevice 19. And by slushing adhesives 20 into each crevice 19 along with the optical fiber core wire 11 and the optical fiber tape 12, the optical fiber core wire 11 and the optical fiber tape 12 are fixed to each crevice 19, and the 2nd attaching part 21 is formed in it.

[0023] By the way, although it is necessary to use the adhesives with which the kind was restricted for junction to the connector 15 and the waveguide substrate 14 by which the optical fiber open wire 16 was held as mentioned above, such [usually] adhesives have a weak bond strength. Moreover, although the adhesion area of the waveguide substrate 14 and a connector 15 is generally as small as abbreviation 1mmx5mm and the bond strength in that case is about 0.5 kgves, now, the hauling force actually applied to an optical fiber cannot be borne (for this reason, conventionally, as shown in drawing 6 , adhesion area with a connector area is increased using the block 3 for reinforcement).

[0024] As for the hauling examination of the optical fiber in an optical-waveguide module, evaluation is usually performed by the intensity of 1kgf. Even if it is not a hauling examination, in case an optical-waveguide module is dealt with, a possibility

that it may be added easily has the hauling force of about 1 kgf in an optical fiber according to an operator's inattention etc. Therefore, the larger force to the optical-waveguide substrate 14, a connector 15, and a bond part than a bond strength will become this thing, and fracture, an imperfect alignment, etc. will arise in this bond part.

[0025] Then, in this example, the kind of adhesives and the length of jointing are decided and the bond strength of the 2nd attaching part 21 which fixes the optical fiber core wire 11 and the optical fiber tape 12 to a case 10 is fixed so that it may become larger than the intensity of the 1st attaching part 17 which fixes the waveguide substrate 14 and a connector 15. In this case, as for the bond strength of the optical fiber core wire 11 and the optical fiber tape 12 in the 2nd attaching part 21, and a case 10, it is desirable to fix so that it may be set to 1 or more kgves.

[0026] Adhesive strength with three kinds of adhesives, an optical fiber, and the fiber covering section is shown in Table 1.

[0027]

[Table 1]

接着剤の密着力

| | 接着剤A | 接着剤B | 接着剤C |
|----------------------|--------|--------|--------|
| ファイバ被覆部との密着力 (Kg/mm) | 0. 1 3 | 0. 0 7 | 0. 1 1 |
| 石英光ファイバとの密着力 (Kg/mm) | 0. 3 6 | 0. 1 2 | 0. 2 8 |

[0028] For example, when the adhesives of A of Table 1 are used, hauling force 1kgf can be borne by setting the length of the adhesives of a case 10 and an optical fiber 16 to 8mm or more. Furthermore, since excessive stress is not applied to the joint of the optical-waveguide substrate 14 and a connector 15, the Young's modulus of adhesives is 2 50kg/mm. It is desirable that it is above.

[0029] Next, drawing 2 shows the 2nd example. In this 2nd example, a part of covering of the optical fiber core wire 11 and the optical fiber tape 12 is removed in the 2nd attaching part 21.

[0030] According to this 2nd example, since both the nakedness fiber section 22 and the covering section 23 are connected to a case 10 through adhesives 20, even if the optical fiber open wire 16 exfoliates [external force] from the covering section by this thing in the covering circles of the optical fiber core wire 11 or the optical fiber tape 12 in the optical fiber open wire 16, external force does not attain to the bond

part of the connector 15 and the ***** substrate 14 by which the optical fiber open wire 16 in a case 10 was held.

[0031] Moreover, in the 2nd example, since the adhesive strength of adhesives with the quartz glass which is the material of optical fiber open wire is stronger than the nylon which is the material of the fiber covering section in many cases, they can combine an optical fiber still more firmly to a case 10, and they shorten the length of the 2nd attaching part 21, and can miniaturize an optical-waveguide module. For example, when the adhesives A of Table 1 are used, if the length which the covering section has pasted up by removing covering of an optical fiber 2mm is about 2.2mm, it can bear the hauling force of 1kgf.

[0032] Drawing 3 shows the 3rd example. In the 2nd attaching part 21, by removing a little front covering [a part of] from each nose of cam of the optical fiber core wire 11 and the optical fiber tape 12, the nakedness fiber section 22 was exposed and this nakedness fiber section 22 and the covering section 23 located in the ends have fixed to the case 10 with adhesives 20 in this 3rd example.

[0033] According to this 3rd example, even if external force is applied to the optical fiber open wire 16 and ablation arises in the optical fiber core wire 11 or the optical fiber tape 12 like the 2nd example at the optical fiber open wire 16 and the covering section, external force does not attain to the bond part of the connector 15 and the optical-waveguide substrate 14 by which the optical fiber open wire 16 was held in the case 10, and the optical fiber open wire 16 is not fractured.

[0034] Drawing 4 shows the 4th example. The example in which the 2nd attaching part 24 was formed in the interior of a case 10 is shown by this 4th example. First, the susceptor 25 is arranged in the interior of a case 10, and the waveguide substrate 14 is laid in the upper surface center section of this susceptor 25. Moreover, two connectors 15 are laid in the neighbors of the waveguide substrate 14, each of this connector 15 is fixed with adhesives to the ends side of the waveguide substrate 14, and the 1st attaching part 29 is constituted.

[0035] The connector 15 of the left-hand side in drawing 4 is structure as shown in drawing 5 . That is, the optical fiber core wire 11 was led to the chip 26 upper surface of Si material, the optical fiber open wire 16 fitted into V groove 27 formed at the nose of cam of the transverse plane of this chip, it pressed down on the chip upper surface, and the board 28 has pasted up. in addition, the connector 15 of the right-hand side in drawing 4 -- the connector 15 of the above-mentioned left-hand side, and abbreviation -- it is the same structure and fitting fixation of each optical fiber open wire 16 of the optical fiber core wire 12 is carried out at two or more V grooves

formed in a connector 15

[0036] Let the both ends of a susceptor 25 be the starting sections 30. The optical fiber core wire 11, the nakedness fiber section 22 which removed a part of covering of the optical fiber tape 12, and the covering section 23 located in the ends of this nakedness fiber section 22 have ridden on the upper surface of each starting section 30, the outside is covered with adhesives 20, and the 2nd attaching part 24 is formed in it.

[0037] Moreover, the optical fiber core wire 11 and the optical fiber tape 12 insert in the side attachment wall 18 of a case 10, and are led outside. In this 4th example, the bond strength of the 2nd attaching part 24 is prepared more greatly than the bond strength of the 1st attaching part 29 which the waveguide substrate 14 and a connector 15 come to paste up.

[0038] Therefore, even if according to this 4th example external force is applied to the optical fiber open wire 16 and ablation arises in the optical fiber core wire 11 or the optical fiber tape 12 like each previous example at the optical fiber open wire 16 and the covering section 23, external force does not attain to the bond part of the connector 15 and the optical-waveguide substrate 14 by which the optical fiber open wire 16 was held, and the 1st attaching part 29 is not fractured.

[0039] In addition, in the 4th example, although the susceptor 25 has been independent of a case 10, this is for making assembly of an optical-waveguide module easy. Therefore, you may fix a susceptor 25 to a case 10.

[0040] Moreover, since this invention relates to the mounting structure of an optical-waveguide module, an optical waveguide may not be limited to a quartz system, but may be a semiconductor and ferroelectric material. Furthermore, the connector 15 which is the 1st attaching part can also consider various material other than Si material, such as glass. The member which constitutes a case 10 and the 2nd attaching part 21 and 24 should just fill the resistance to environment of optical-waveguide modules, such as aluminum, SUS, and plastics.

[0041]

[Effect of the Invention] As explained above, according to the optical-waveguide module of this invention, by having made the bond strength of the fixed part of a case and an optical fiber into size rather than the bond strength of the bond part of an optical waveguide and an optical fiber It is the thing the external force did not attain to the bond part of the optical waveguide and optical fiber which are contained in a case, but this bond part fractured or the imperfect alignment was able to be prevented from producing even if the mechanical hauling force acted on the optical fiber. It is effective

if it applies to the package of the optical-waveguide module used for fiber optics communication.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective diagram of the optical module concerning the 1st example.

[Drawing 2] some optical modules concerning the 2nd example -- it is an ellipsis plan

[Drawing 3] some optical modules concerning the 3rd example -- it is an ellipsis plan

[Drawing 4] some optical modules concerning the 4th example -- it is an ellipsis plan

[Drawing 5] It is the perspective diagram of the connector of drawing 4 .

[Drawing 6] It is the cross section showing the joint structure of the conventional optical waveguide and an optical fiber.

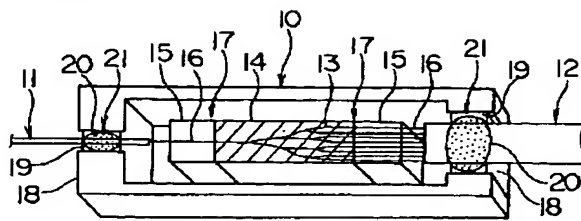
[Description of Notations]

10 [-- An optical fiber tape, 13 / -- An optical waveguide, 14 / -- A waveguide substrate, 15 / -- A connector, 16 / -- Optical fiber open wire, 17 / -- The 1st attaching part, 20 / -- Adhesives, 21 / -- The 2nd attaching part, 22 / -- The nakedness fiber section, 23 / -- The covering section, 25 / -- Susceptor.] -- A case, 11 -- Optical fiber core wire, 12

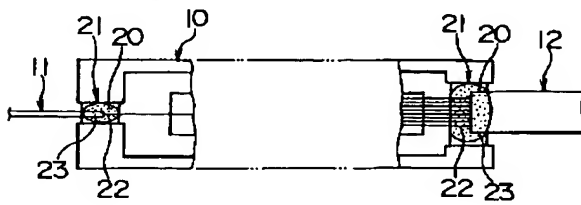
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DRAWINGS

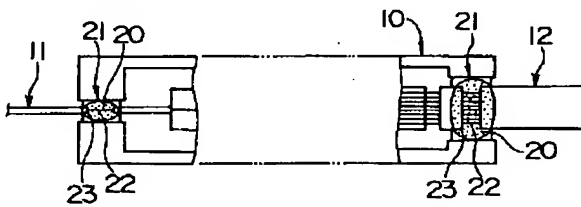
[Drawing 1]



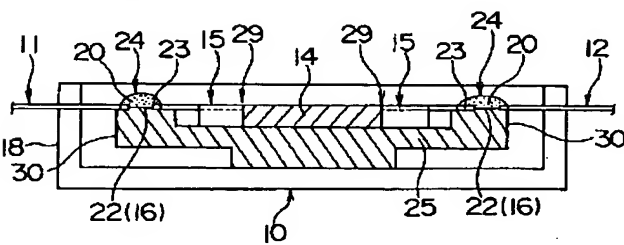
[Drawing 2]



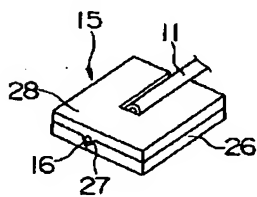
[Drawing 3]



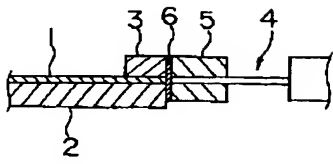
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]